



Evaluating the Use of Unmanned Aerial Systems (UAS) for Transportation Purposes

Matthew Brinker
Aeronautic Specialist

Steven J. Cook, P.E.
Engineer of Operations & Maintenance



Popularity & Proliferation of UAS

- Unmanned vehicles have been around for a long time!
- Several million privately-owned UAS in the U.S.
- The Consumer Technology Association estimated that 400,000 UAS were purchased during the 2015 Christmas holiday season
- The FAA received more than 45,000 applications during the first two days of its registration program which began 12/21/2015



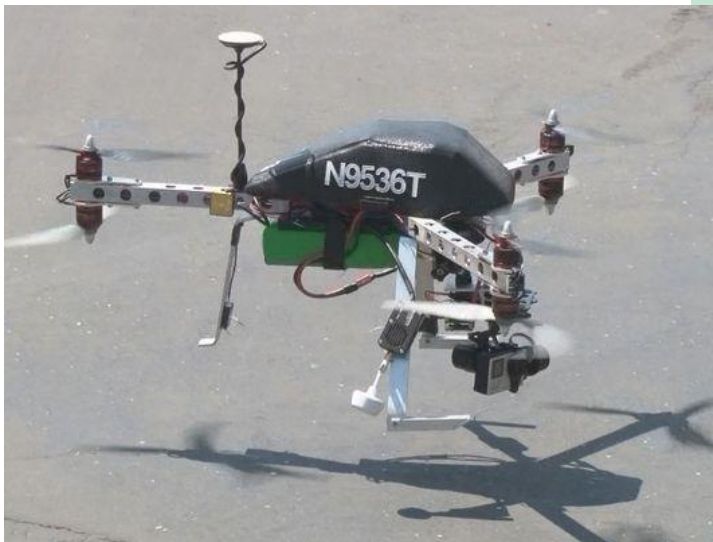
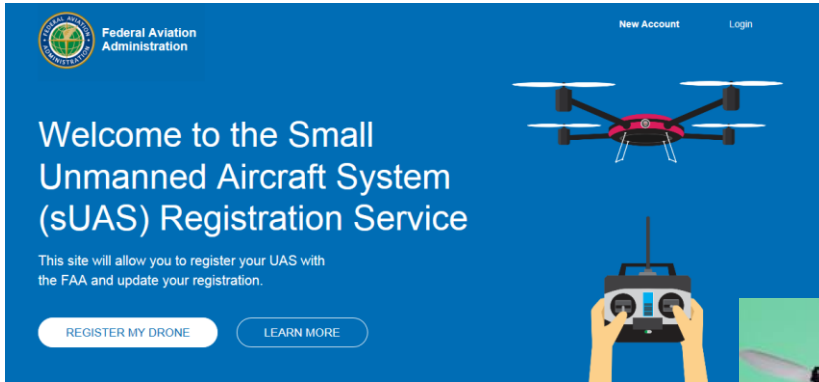
Safety Concerns

Integrating UAS Into the National Airspace System



Safety Concerns

Ensuring Accountability



Safety Concerns

Educating the UAS Community



knowbeforeyoufly.org



App Store



State Regulation of UAS

Michigan Legislature 2015-2016 Session

- SB 432** Bans flight within 1,000' of the Mackinaw Bridge
- SB 487/HB 4866** Restrict operations over prisons/jails
- SB 549/HB 5148** Prohibits flight over State Capitol grounds
- SB 700** Bans flight over public lands, establishes operating limitations on UAS, specifies pilot licensing criteria for UAS operators
- HB 4868** Prohibits interference with a public safety activity (I.E. law enforcement or fire fighting) or the provision of a public utility
- HB 5026** Establishes limitations on UAS use for law enforcement & data gathering



Federal Regulation of UAS

FAA Modernization and Reform Act of 2012 Required FAA to provide a plan for the ...”safe integration of civil unmanned aircraft systems into the national airspace system as soon as practicable, but not later than September 30, 2015”

- Non-governmental, commercial operators must apply for a waiver to section 333
- Governmental operators must apply for a Certificate of Waiver or Authorization (COA) in accordance with provision of Title 49 U.S.C. § 40125

FAR Part 107 Proposed “small UAS” regulation to codify operational limitations for commercial UAS weighing less than 55lbs. The regulation may also allow additional flexibility for “micro UAS” weighing less than 4.4 lbs.

UAS Benefits for Transportation

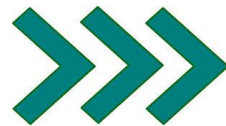
- Safety
- Mobility
- Efficiency
- Legacy Liability
- Economic Development



Minimize Lane Closures

MDOT Research Phase I - UAS Possible Applications

- Aerial inspections - infrastructure condition state and assets management
- Confined space inspections
- Traffic operations monitoring
- Photo imaging (high resolution photogrammetry)
- Thermal infrared technologies
- LiDAR surveying and mapping



UAV Platforms

- Bergen Hexacopter (\$5,400)



- Mid-sized UAV – Phantom (\$800)



- Micro UAV (\$150)



- Blimp (\$1,000)



Bridge Inspection



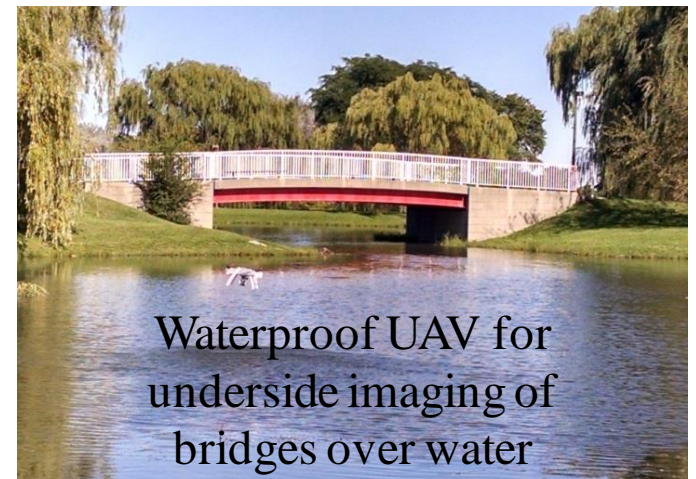
Non-Destructive Evaluation of Bridge Elements

- Used to detect surface conditions
 - Bridge deck delamination, potholes, cracks, patching, etc.
- Overlapping imagery can be used to generate 3D models to characterized condition state of deck bridge



Traffic Operations

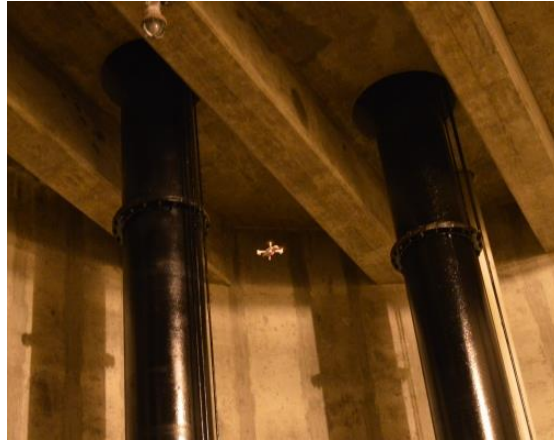
Construction site imaging



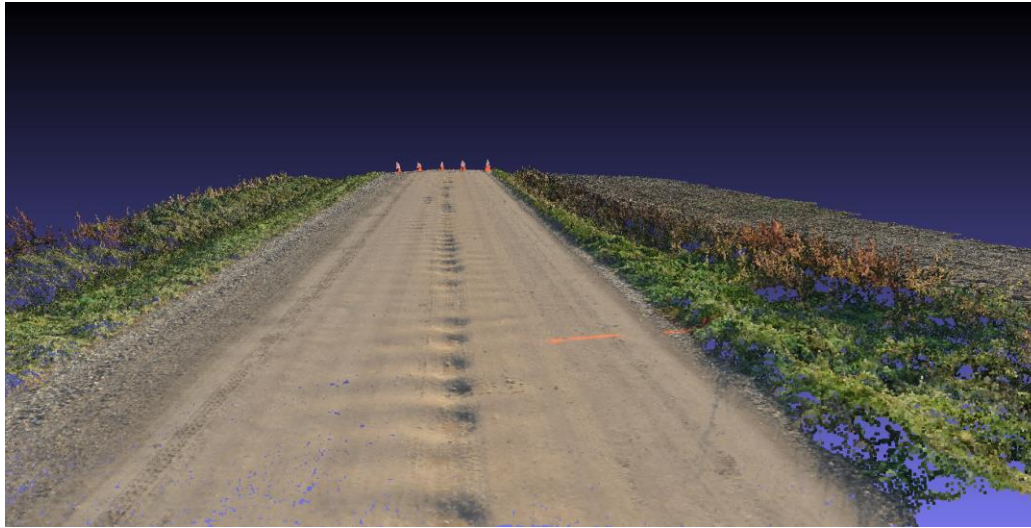
Waterproof UAV for
underside imaging of
bridges over water

Confined Space Inspections

- Capability to fly in confined spaces
 - MDOT Pump Stations
- Is it safe to send a person in?
 - unlit spaces
 - assess environmental condition state (air quality, etc.)
- Successfully tested with live video feed via iPhone



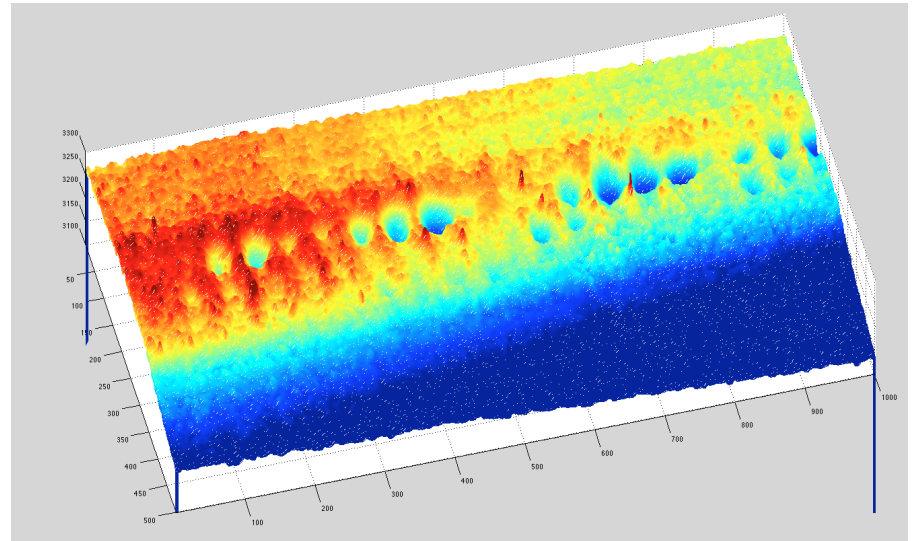
Mapping Condition State of Unpaved Roads



3D point cloud of an unpaved road using photo/image reconstruction



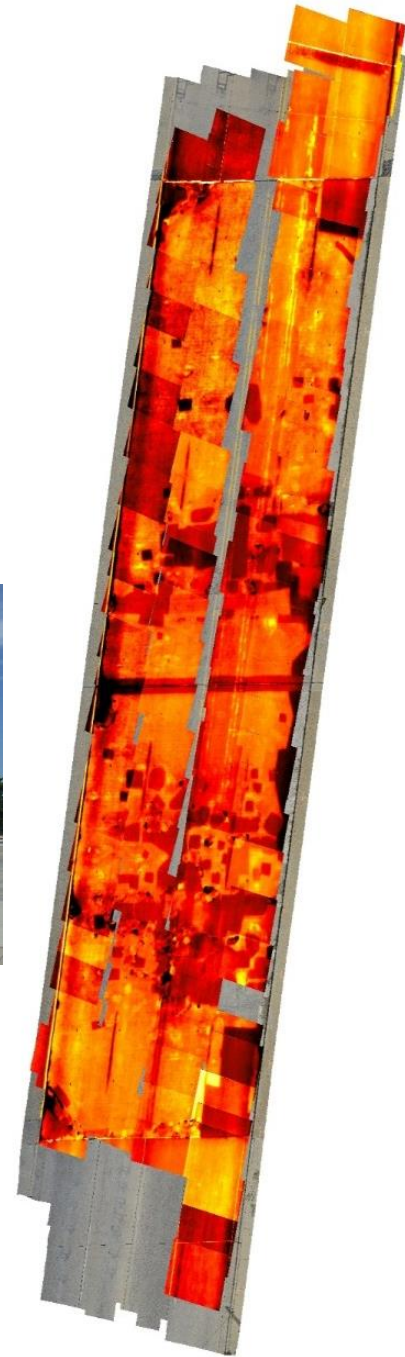
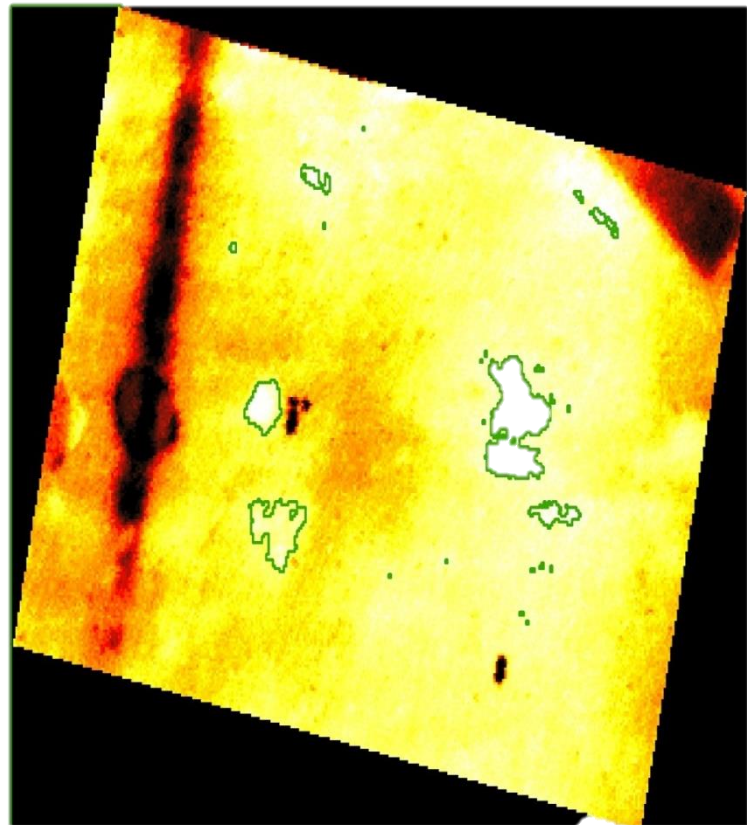
Aerial photo of unpaved road from UAV



3D mapping of potholes on unpaved road

UAV Thermal Infrared Scanning

- Detection of subsurface condition
- Infrared imagery automatically detects delamination (left, green polygons)



UAV Crash Reconstruction - Traffic Incident Management



MDOT UAS Phase II Research (April 2016 – 2 year project)

1. Data collection capabilities
2. Use board sensing technologies for three (3) MDOT assets
3. Ensure data collected accuracy/quality compared to current data collection systems at MDOT
4. Provide Implementation Plan, User Guidance Document, and Training
5. Determine the return on investment (benefit/cost analysis)
6. Secure an FAA COA or Section 333 Exemption
7. Final Report Phase I: “RC-1616 Evaluating the Use of Unmanned Aerial Vehicles for Transportation Purposes” on MDOT website



Thank you!

